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INTRODUCTION

Z-XLR8 is a software based cassette tape storage system for ZX81/ TS 1000 computers. Its primary advantage over the Sinclair LOAD and SAVE routines is speed. Typically, an 8K BASIC program will load in less then 30 seconds with Z-XLR-8. By comparison, almost 4 minutes are required to load the same program with the Sinclair LOAD routine. To further enhance the system there are also these outstanding features.

-FAST ARRAY VARIABLE LOADING and SAVING. Dimensioned variables (numeric or string) can be loaded or saved independent of the program. In this manner, data files can be created

-FAST BINARY DATA LOADING and SAVING. Binary data (machine code) can be directly loaded and saved anywhere in RAM.

-FAST GRAPHICS LOADING and SAVING. One command loads or saves the picture displayed on the television screen. This can be either text or graphics. Again, this is independant of any BASIC program. And of course at high speed.

-FAST INDEXING OF THE TAPE. Did you forget what is stored on a tape? The "IL" command initiates a routine which scans the tape and displays the name and type of each Z-XLR8 file on the tape.

-ERROR CHECKING. A file checksum insures a successful load was completed.

In all, Z-XLR8 will now give you 11 tape system commands.

(PL) Program Load	(PS) Program Save
(DL) Data Load	(DS) Data Save
(BL) Binary Load	(BS) Binary Save
(GL) Graphics Load	(GS) Graphics Save
(HL) High Res. Graph Load	(HS) High Res. Graph. Save
(IL) Index Load	

Z-XLR8 routines operate differently then the Sinclair LOAD and SAVE routines. As such, programs saved by Z-XLR8 cannot be loaded by the Sinclair LOAD command, and vice versa.

We recommend the following for successful operation of Z-XLR8.

1. Use only high quality audio or (preferably) data cassettes.
2. Avoid using the first 10 seconds of tape beyond the leader. This is an error prone area of the tape.
3. Use a cassette player/recorder with a tape counter. Record the counter number where each new file begins.
4. Avoid starting to load the the tape in the middle of a file.
5. Use an AC adapter or the AC option for the cassette deck.
6. Make sure the tape head(s) are clean and demagnitized . The capstan and rollers should also be clean.

To summarize, if you are not having any difficulty loading and saving with the Sinclair routines, you should not experience any trouble with Z-XLR8. Remember, Z-XLR8 is a software based system. Its operation depends solely on the performance of YOUR equiptment.

CASSETTE VERSION

There are two programs contained on the supplied cassette. The first is the Z-XLR8 operating system ("Z"). The second program is a calibration program. Calibration is not a requirement to run Z-XLR8. However, for those who wish to check data transfer reliability and or to increase the speed of Z-XLR8 we recommend running the calibration program.

If you decide not to calibrate your system at this time, use the following two values in response to the required inputs in the Z-XLR8 operating system program ("Z").

TIMING VALUE = 15

CALIBRATION VALUE = 234

Then continue with the section titled " LOADING Z-XLR8 ".

CALIBRATION

1. Load the program "C" contained on the Z-XLR8 cassette. This is the calibration program. Tha calibration program will automaticlly run after loading.

   LOAD "C" (ENTER)

2. You will need a blank cassette for calibration. Make sure to start it beyond the leader (if one exists).

3. Follow the directions as displayed on the screen. The instructions and their directions are as follows:

REWIND AND REMOVE PROGRAM TAPE THEN INSERT BLANK TAPE.

This is self explanatory. Remember to start the blank tape after the leader.

INPUT TIMING VALUE

This is a number which must be entered to set the speed at which Z-XLR8 stores files on tape. The better the equiptment, the faster the system can be made to operate. Timing values ranging from 15 (fast) to 10 (fastest) appear to work best. Typical times to SAVE LOAD 16k bytes with various timing values are tabulated below.

Timing Value	Time to SAVE/LOAD 16k bytes
15	60 sec
14	57 sec
13	54 sec
12	51 sec
11	48 sec
10	45 sec

There is a trade off between data transfer speed (timing value) and reliability. The faster the transfer speed (the lower the timing value), the more likely errors will be introduced. Therefore, we recommend initially starting with a timing value of 15. At the end of calibration the performance of your equiptment will be displayed. At that time you can decide if a faster transfer speed can be handled by your cassette deck.

Type in a timing value (initially 15) and press ENTER (NEWLINE) to continue.

START RECORDING TAPE

If you have found it necessary to disconnect one of the tape connections while loading or saving with the Sinclair commands, you must do the same for calibration and operation of Z-XLR8.

After starting the cassette to record, press any key to begin outputting calibration data. This calibration file has a length equivelent to that of a 16k program. Depending on the timing value you input, you should be able to approximate the time required to perform this recording operation.

While the calibration file is being output, you should notice fine lines, possibly distorted, appearing on the television screen.

STOP RECORDING TAPE

Stop the cassette deck. The calibration file has been output and stored.

REWIND THE TAPE HALF WAY

It is not necessary mj and in fact undesireable - to start playing the calibration file at the very beginning. Therefore, rewind the tape only about half way back through the file. Positioning is not critical since the file contains the same information repeated 1000s of times. This is the one case where it does not matter that the file has started in the middle (try to avoid this when using Z-XLR8).

START PLAYING THE TAPE

As with the Sinclair routines, Z-XLR8 is sensitive to the volume and tone (if available) control settings of the cassette deck. However, because you are calibrating your equiptment, you can select any control settings which are convenient. The system will then be calibrated for these settings. In most cases we have found setting the volume and tone controls to maximum output produced the best results.

After starting to play the cassette, press any key to input a short segment of calibration data. This loading procedure should only take a few seconds.

STOP PLAYING THE TAPE

Stop the cassette deck. After pressing any key, the calibration program program begins examining data which was input from the tape. The calibration calculations normally take about 45 seconds to complete. If bad data was input, the program may abort prematurely with:

```
BAD CALIBRATION
TIMING VALUE TOO LARGE
```

This can occur if a timing value greater than 15 is used.

A successful calibration is indicated by a display similar to this:

```
  TIMING VALUE = 15

CALIBRATION VALUE = 236

  GOOD CALIBRATION
       ******
PRESS ANY KEY TO CONTINUE
```

The timing value is the number you selected. the calibration value is the number which was calculated from the calibration data aquired from your cassette deck. It is an equiptment dependant variable, and must be input into Z-XLR8 in order for Z-XLR8 to function correctly. The fact that the calibration program displayed "GOOD CALIBRATION" indicates no errors were detected in the sampled data.

Below "GOOD CALIBRATION" appears a number of asterisks. These rate the performance of your equiptment. The more astrisks, the lower the possibility of a data transfer error. To rate your system, use the following guide.

7 or more	* :	Excellent system, should experience very few errors.
5 to 6	* :	Good system. Operateable at this speed May fin an occasional error.
1 to 4	* :	Poor system or operating to fast (timing value too small). Expect frequent errors.

You should always select a timing value and control settings which produce a calibration rating of at least 5 *. At this time write down the timing value you selected, the respective calibration value and the number of astrisks. Save this data for future reference.

If the result of the calibration was "BAD CALIBRATION", you will have to take the corrective action displayed. Setting the volume control near the position used to LOAD Sinclair formatted tapes may help.

```
Press any key to continue.

                SELECTION

        1.   RESTART
        2.   RECALIBRATE
        3.   STOP

             INPUT SELECTION NUMBER
```

RESTART : Starts the calibration program over. Select this command if you wish to try a different timing value If the result of the previous calibration was "BAD CALIBRATION" you should also select this command.

RECALIBRATE : Permits a new sample of calibration data to be loaded from the same file. Proceed with loading as before. The results of this calibration should be nearly the same as before (+/- 1 calibration unit, +/- 1 asterisk). We recommend recalibrating 3 to 4 times for each timing value.

STOP : This terminates the calibration program.

```
              CALIBRATION COMPLETE
```

LOADING Z-XLR8

1. Load the program named "Z" from the Z-XLR8 cassette. Be sure the volume control is set to LOAD a Sinclair formatted tape. Z-XLR8 will run automatically.

2. Input Timing Value. This is the same value derived from the calibration process.

3. Input Calibration Value. This is the average value given with timing value used.

4. Input Z-XLR8 Starting Location. Enter the decimal address of the starting location in RAM where Z-XLR8 should be placed. This becomes the calling address of Z-XLR8. Because Z-XLR8 occupies 2K of RAM, the highest starting location is 30600, allowing about 120 bytes for stack operations.

   If you decide to leave Z-XLR8 in the first REM statement enter 0 for the starting location. Lines 9000 to 9082 can then be Deleted.

   We recommend placing Z-XLR8 at some address which is convenient to call, such as 30000. Locating Z-XLR8 above 18500 automatically sets RAMTOP to point to the memory location just below Z-XLR8. By doing so the NEW command has no effect on Z-XLR8. In fact, after setting RAMTOP the loading program itself executes the NEW command, clearing the workspace.

   NOTE: Z-XLR8 can be located below 16384 if RAM is available.

5. Z-XLR8 is now ready to run.

OPERATING Z-XLR8

Z-XLR8 is called with the USR function, followed by the calling address. Typical calling statements could be:

```
RAND USR 30000
PRINT USR 30000
LET A= USR 30000
```

(30000 is used as an example calling address)

If Z-XLR8 is located within the first REM statement, the calling address is 16515. NOTE, Z-XLR8 can be called from eather the program or immediate modes.

Z-XLR8 is interactive. It requires you to input file names, commands, and other information as needed. After entering the requested information, continue the program with ENTER or (NEW LINE). Use the DELETE or RUBOUT function to correct mistakes. Z-XLR8 will indicate when to start and stop the cassette deck. Error messages will also be provided.

After finishing the desired routine, Z-XLR8 will transfer control back to the calling program, or the immediate mode.

After calling Z-XLR8, the first information to be entered is a file name. This is a string of up to 7 characters. More then 7 characters can be entered, but only the first 7 will be stored as the file name. All alphanumeric and shifted characters are valid entries. Once the file name has been typed press ENTER or NEWLINE to continue.

Following a file name entry, Z-XLR8 will request a command be entered. Z-XLR8 has eleven commands which can be seperated into two catagories: SAVE and LOAD. There are five SAVE and six LOAD commands.

COMMAND	DESCRIPTION
PS	Program Save: Saves a BASIC program. Including system and program variables, and the display file.
GS	Graphics Save: Saves the picture displayed on the television screen. Only the upper 22 lines are actually saved; lines 23 and 24 are reserved for Z-XLR8 and the Sinclair operating system.
DS	Data Save: A dimensioned variable array, either numeric or string, will be saved in its entirety with this command. For example, assume the statement DIM B(20) exists in a program. After requesting the DS command, Z-XLR8 askes you to input the name of the dimensioned array which is to be saved (in this case B). Z-XLR8 will then search the program variables for the array B, and then save the entire array on tape. Several arrays can exist in a single program, both string and numeric, but only one array can be stored at a time. Z-XLR8 leaves the array and all other variables unaltered during a Data Save.
BS	Binary Save: Any number of contiguous bytes in memory can be Saved with the BS command. After entering the BS command Z-XLR8 asks you to enter a starting address. This can be input as either a decimal or hexadecimal value. Preceed a hexadecimal entry with $, and be sure to specify all four hexadecimal digits. Valid entries are 0 to 65535 decimal, or $0000 to $FFFF hexadecimal. Do not enter spaces or commas in the middle of an entry. Following input of the starting address, the number of bytes to be saved must be entered. This is the file length. Again, enter this value in either decimal or hexadecimal format.
HS	High Resolution Graphics Save: This routine automatically stores binary data between memory locations 8192 and 14335 decimal. This is the 6K of memory used for Advanced Interface Design's high resolution bit mapped graphics board.

Note: It is implied a record operation should be performed when Z-XLR8 instructs you to "START TAPE" during SAVE commands.

[illegible]

COMMAND	DESCRIPTION
HS	High Resolution Graphics Save: This routine automatically stores binary data between memory locations 8192 and 14335 decimal. This is the 6K of memory used for Advanced Interface Design's high resolution bit mapped graphics board.
PL	Program Load: Loads a BASIC program, including program, system variables, and the display file.
GL	Graphics Load: This command loads the display file in RAM with the file caled. While loading, Z-XLR8 checks the file to see if it is a G type file (G= Graphics). If it is not, an ERROR 4 will result. Loading a G file is independent of the location of the display file in RAM.
DL	Data Load: After specifying the file name and the command, Z-XLR8 will request you to enter an array name which has been previously dimensioned within a program. This array will be loaded with the data stored on tape. This array name does not have to be the same as the name of the array stored on tape. For example loading saved array B into dimensioned array C is completely acceptable. In this case array C must be dimensioned as long or longer than the array B which will loaded from the tape. If the dimensioned array is not as large as the one which is being loaded, an ERROR 6 will occur. The same applies to string arrays. A string array can not be loaded into a numeric array, and vice-versa. An attempt to do so will produce an ERROR 5. Remember , string arrays must be followed with the $ character. Z-XLR8 can distinguish between a string array labled A$ and a numberic array labled A which simultaneously exist in the program variables. Multidimensional arrays are handled similarly. It now more important the dimensioned and saved arrays have the same initial dimed sudscripts. Failure to do so may produce some unpredictable results relating to arraay handling. Only D type files can be loaded with the DL command. Attempting to load another type of file will produce an ERROR 4.
BL	Binary Load: Z-XLR8 will request a starting address after the file name and BL command are entered. The starting address specifies where in RAM the binary file will begin to be loaded. Consecutively higher memory locations will be filled for the entire length of the file. For this reason, the file length is not required as an input (the entire file will be dumped). Inputting 0, zero, for the starting address causes Z-XLR8 to

COMMAND	DESCRIPTION
	start loading the binary data at the starting address from which the file originated. This information is stored as part of the file. For reinstalation of address dependent machine cade, this is an extremely useful feature. Again, the starting address can be in decimal or hexadecimal format. Any type of file can be loaded with the BL command. However, due to error checking, loading a P type file with the BL command will almost always produce an ERROR 2. This does not necessarily mean a data transmission error occured in this situation.
HL	High Resolution Graphics Load: This routine automatically loads binary data between memory locations 8192 and 14335, decimal.
IL	Index Load: This command calls a routine which searches the tape for Z-XLR8 files. During the search, the television screen is dark. Upon finding a Z-XLR8 file, the file specifications are displayed. These include file name, file type (P= Program, D= data, B= binary, G= graphics, H= high res graphics), and file length (decimal number of bytes). Additionally, for binary files the starting address is provided (in decimal) and for data files the stored array name is displayed. The display will appear for approx. 4 seconds, afterwhich the program resumes its search. The IL routine is terminated by pressing the BREAK key whike the program is searching. Following this, all file specifications preceeding the break will be displayed.

The best way to learn Z-XLR8 commands is by using them. To assist you, the following demonstrative examples are provided. Notice the assume the calling address of Z-XLR8 is 30000. Change this if you have relocated Z-XLR8 elsewhere. Also, in the following examples the colen (:) is present to indecate user input. The colen itself is NOT TO BE ENTERED. First enter the demonstration program, then run it. The display should be filled with the character set repeted eleven times. In the 23rd line the statement "INPUT FILE NAME" should appear. This indecates Z-XLR8 was properly called in statement 65.

At this time insert a blank tape in your recorder. Advance the tape approx. 10 seconds past the leader to bypass the "glitch" region then proceede with each of the command examples. Remember, always press ENTER or NEWLINE after completion of an entry or instruction.

```
10 REM DEMONSTRATION PROGRAM
15 DIM A(10)
20 DIM B(15)
25 FOR I=1 TO 10
30 LET A(I)=I/7
35 NEXT I
40 FOR K=1 TO 11
45 FOR J=0 TO 63
50 PRINT CHR$ J;
55 NEXT J
60 NEXT K
65 RAND USR 30000
70 CLS
75 FOR I=1 TO 10
80 PRINT A(I),B(I)
85 NEXT I
90 STOP
```

EXAMPLE 1. Binary Save: Stores 4K of Sinclair ROM. Run the demonstration program, then continue with the example after Z-XLR8 has been called (line 65).

Command	Responce	Action
INPUT FILE NAME:	BINARY1	PRESS (ENTER)
INPUT COMMAND	BS	" "
INPUT ADDRESS	2048	" "
INPUT LENGTH	$1000	" "
START TAPE	(RECORD)	" "
STOP TAPE		" "

You have just saved 4K of the ROM chip, then the program returned to basic.

EXAMPLE 2. Program Save: Saves the demonstration program. Run the demonstration program and continue with the following example.

INPUT FILE NAME	PROG1	PRESS (ENTER)
INPUT COMMAND	PS	" "
START TAPE	(RECORD)	" "
STOP TAPE		" "

You have saved the Demonstration Program, then the pro-returned to Basic.

EXAMPLE 3. Date Save: Saves numeric array A. Run the demonstration program and continue with the following example.

INPUT FILE NAME	DATA	PRESS (ENTER)
INPUT COMMAND	DS	" "
INPUT DIM VARIABLE	A	" "
START TAPE	(RECORD)	" "
STOP TAPE		" "

You have saved array A, then the program returned to Basic.

EXAMPLE 4. Graphics Save: Saves the characters (graphics) displayed on the television screen. Run the demonstration program and continue with the following example.

Command	Responce	Action
INPUT FILE NAME	GRAHPIC	PRESS (ENTER)
INPUT COMMAND	GS	" "
START TAPE	(RECORD)	" "
STOP TAPE		" "

The Display File has been saved, then the program returned to Basic.

EXAMPLE 5. Index Laod: Rewind the tape. Set the controls to the calibration settings. This time, call Z-XLR8 from the immediate mode with the following.

INPUT FILE NAME		PRESS (ENTER)
INPUT COMMAND	IL	" "
START TAPE	(PLAY)	" "

When the 1st Z-XLR8 file is found, the display should list the file specifications. Press the BREAK key after all 4 files have been found.

STOP TAPE   Press STOP on your tape deck.

EXAMPLE 6. Binary Load. Rewind the tape. Call Z-XLR8 by either running the demonstration program, or with an immediate call (RAND USR 30000).

INPUT FILE NAME	BINARY1	PRESS (ENTER)
INPUT COMMAND	BL	" "
INPUT ADDRESS	24000	" "
START TAPE	(PLAY)	" "

Z-XLR8 will search for a binary file, then LOAD's it.

STOP TAPE   Press STOP on your tape deck.

Returns to calling program or immediate mode. No ERROR statement indecates a successful LOAD.

EXAMPLE 7. Program LOAD. Clear program workspace with NEW. Call Z-XLR8 from the immediate mode.

INPUT FILE NAME	PROG1	PRESS (ENTER)
INPUT COMMAND	PL	" "
START TAPE	(PLAY)	" "

Z-XLR8 will search for the file, then LOAD it.

STOP TAPE   Press STOP on your tape deck.

After loading, the program will execute lines 70 throgh 90 because the program was saved within itself. That is, the system variables were saved as the program was being executed. LIST the program for your examination.

EXAMPLE 8. Data LOAD. Load the numeric data into numeric array B. Run the demonstration program.

Command	Responce	Action
INPUT FILE NAME	DATA	PRESS (ENTER)
INPUT COMMAND	DL	" "
START TAPE	(PLAY)	" "

Z-XLR8 will search for the file, then LOAD it.

STOP TAPE Press STOP on your tape deck.

The program will continue, displaying arrays A and B. Both arrays will now contain the same values for the 1st 10 array elements displayed. This is due to loading the data file named DATA into array B.

EXAMPLE 9. Graphics LOAD. Clear the display with CLS. Call Z-XLR8 from immediate mode.

INPUT FILE NAME	GRAPHIC	PRESS (ENTER)
INPUT COMMAND	GL	" "
START TAPE	(PLAY)	" "

Z-XLR8 will search for the file, then LOAD it.

STOP TAPE Press STOP on your tape deck.

The television screen should be filled with the repeating character set. This is the display initially generated by the demonstration program, but now stored on tape.

You should now understand how to call and operate Z-XLR8.

ERROR MESSAGES.

1 = Bad file header. File can not be loaded.
2 = Data transmission error. File has been loaded, but has errors.
3 = Dimension error. No array found with entered name.
4 = File type error. Attempt to load wrong type of file.
5 = Array type error. Attempt to load numeric array into a string array or vice-versa.
6 = Array length error. Attempt to load larger array from tape Than can be accomodated by the specified array in the variable workspace.

Dealing with the Inevitable

At one time or another you will experience a "glitch" which will crash the system. This can be caused by many things, however, for Z-XLR8 there are several dominate factors:

1. Tape Quailty. For reliable high denssity recording use only high quality audio, or better yet, data cassettes.

2. Noise. Noise is primarily introduced through the system power supply, RamPacks, and/or the tape deck power supply. Avoid overloading the system power supply with extra hardware additions. Route tape deck MIC and EAR connecting lines away from power lines. The RamPack problem is more difficult to remedy. An indecation of a RamPack problem is difficulty in loading Sinclair formatted tapes when the RamPack is attached compares to when it is not connected. The simplest solution is to exchange the RamPack for another which does not generate as much noise. The source of noise in these RamPacks appears to be the DC to DC converter section. Incorporating larger filtering capacitors in this section significantly reduces the noise. However, this should not be attempted by the inexperineced.

3. Condition of Tape Deck. Make sure heads are clean and demagnitizedmn Overall, the tape should move smooth and steady.

4. 110 VAC Quality. Local interference or disturbances in the 110 VAC supply has a major effect. Several line filters are advertised in any of the major computing magazines. Although good units are not inexpensive, they may be the only solution in this situation.

If the system does crash, there is little that can be done except to remove power, restart, and reload. This is the major disadvantage of keeping an operating system in volatile RAM.

Optional Capacitor Replacement

For more reliable loads with both Z-XLR8 and Sinclair LOAD routines replace the 0.01 ufd capacitor at location C10, near the ear jack, with a 0.10 ufd ceramic disc capacitor.

Z-XLR8 can be operated with timing values ranging from 10 to 25. Although running Z-XLR8 with a timing value of 25 is slower, the detrimental effect of "tape dropouts" is significantly reduced.

Typical Calibration Values for Various Timing Values

Calibration Value = 225	Timing Value = 25
225	24
226	23
227	22
228	21
229	20
230	19
231	18
232	17
233	16
234	15
235	14
236	13
237	12